

|   |  |  |                              |            |                                      |             |                                 |  |            |           |                    |            |                               |             |                  |
|---|--|--|------------------------------|------------|--------------------------------------|-------------|---------------------------------|--|------------|-----------|--------------------|------------|-------------------------------|-------------|------------------|
| Name(s) of Risk Team Members:<br>R. Karol, J. Scott, M. Sivertz, B. Sutherland, P. Bergh                          |  |  | Point Value →<br>Parameter ↓ |            | 1                                    |             | 2                               |  | 3          |           | 4                  |            | 5                             |             |                  |
| Area/Facility Description Title: Collider-Accelerator<br><br>Area/Facility # (if applicable): Area-Wide FRA 16-08 |  |  | Occupancy or Use             |            | ≤once/year                           |             | ≤once/month                     |  | ≤once/week |           | ≤once/shift        |            | >once/shift                   |             |                  |
| Area/Facility Description: NSRL Area-Wide   |  |  | Severity                     |            | First Aid Only                       |             | Medical Treatment               |  | Lost Time  |           | Partial Disability |            | Death or Permanent Disability |             |                  |
|   |  |  | Likelihood                   |            | Very Unlikely                        |             | Unlikely                        |  | Possible   |           | Probable           |            | Multiple                      |             |                  |
| Approved by: <i>E. Lessard</i> Date: 4-3-08      Rev.#: 0   |  |  |                              |            |                                      |             |                                 |  |            | Comments: |                    |            |                               |             |                  |
|   |  |  |                              |            | Reason for Revision (if applicable): |             |                                 |  |            |           |                    |            |                               |             |                  |
|   |  |  |                              |            | Before Additional Controls           |             |                                 |  |            |           |                    |            | After Additional Controls     |             |                  |
| Physical Item or Activity   | Hazard(s)  | Control(s)   | Occupancy A                  | Severity B | Likelihood C                         | Risk* AxBxC | Control(s) Added to Reduce Risk |  |            |           | Occupancy A        | Severity B | Likelihood C                  | Risk* AxBxC | % Risk Reduction |
| Radiation   | <a href="#">See Facility-Wide Radiation Evaluation</a>         | See Facility-Wide Radiation Evaluation   |                              |            |                                      |             |                                 |  |            |           |                    |            |                               |             |                  |
| Dispersible Radiation   | Personnel exposure   | Training, HP coverage, PPE, engineering controls, administrative controls, work planning, postings, RWP  | 4                            | 1          | 3                                    | 12          |                                 |  |            |           |                    |            |                               |             |                  |
| Electrical  | <a href="#">See Facility-Wide Electrical Evaluation</a>        | See Facility-Wide Electrical Evaluation  |                              |            |                                      |             |                                 |  |            |           |                    |            |                               |             |                  |
| Material Handling   | <a href="#">See Facility-Wide Material Handling Evaluation</a> | See Facility-Wide Material Handling Evaluation   |                              |            |                                      |             |                                 |  |            |           |                    |            |                               |             |                  |
| Housekeeping  | <a href="#">See Facility-Wide Housekeeping Evaluation</a>      | See Facility-Wide Housekeeping Evaluation  |                              |            |                                      |             |                                 |  |            |           |                    |            |                               |             |                  |
| Housekeeping  | Biological contamination                                       | Lab specific cleaning procedures, PPE, training, hoods, HEPA filters   | 4                            | 2          | 2                                    | 16          |                                 |  |            |           |                    |            |                               |             |                  |
| Fire  | <a href="#">See Facility-Wide Fire Evaluation</a>              | See Facility-Wide Fire Evaluation  |                              |            |                                      |             |                                 |  |            |           |                    |            |                               |             |                  |
| Water   | Pressure   | Postings, maintenance, PPE, training, work planning, ASSRC review, procedures, Tier 1 inspections, operations by qualified Water Group staff, LOTO, codes and standards usage  | 4                            | 3          | 2                                    | 24          |                                 |  |            |           |                    |            |                               |             |                  |
| Water   | Temperature  | Postings, maintenance, PPE, training, work planning, ASSRC review, procedures, Tier 1 inspections, operations by qualified Water Group staff, LOTO, codes and standards usage  | 4                            | 3          | 2                                    | 24          |                                 |  |            |           |                    |            |                               |             |                  |
| Cryogenic   | Low temperature, frostbite form small quantities of dry ice    | Training, work planning, procedures, PPE, Tier 1 inspection  | 4                            | 2          | 2                                    | 16          |                                 |  |            |           |                    |            |                               |             |                  |
| Pressurized gas   | Struck by a flying object for example flying debris            | Postings, PPE, maintenance, training, work planning, ESRC /ASSRC reviews, procedures, interlock systems, certification/testing of pressure related equipment, Tier 1 inspections, LOTO, C-AD Chief ME reviews, codes and standards usage | 4                            | 3          | 3                                    | 36          |                                 |  |            |           |                    |            |                               |             |                  |
| Pressurized gas   | High pressure gas  | Postings, PPE, maintenance, training, work planning ESRC /ASSRC reviews, procedures, interlock systems, certification/testing of pressure related equipment, Tier 1 inspections, LOTO, C-AD Chief ME reviews, codes and standards usage  | 4                            | 3          | 3                                    | 36          |                                 |  |            |           |                    |            |                               |             |                  |

|   |  |  |          |   |   |    |             |  |  |               |  |
|---|--|--|----------|---|---|----|-------------|--|--|---------------|--|
| Vacuum  | Ear damage   | Postings, PPE, maintenance, training, work planning, ASSRC/ESRC reviews, procedures, Tier 1 inspections, Chief ME reviews, vacuum windows covered during handling, use of industry standards, design reviews   | 4        | 4 | 2 | 32 |             |  |  |               |  |
| Vacuum  | Struck by a flying object for example flying debris  | Postings, PPE, maintenance, training, work planning, ASSRC/ESRC reviews, procedures, Tier 1 inspections, Chief ME reviews, vacuum windows covered during handling, , use of industry standards, design reviews | 4        | 4 | 2 | 32 |             |  |  |               |  |
| Still for Distilled Water   | Burns, fire  | Postings, barriers, maintenance, training, work planning, ASSRC/ESRC reviews, procedures, Tier 1 inspections, design reviews, LOTO   | 4        | 2 | 2 | 16 |             |  |  |               |  |
| Lasers  | Eye damage   | Barriers, interlock systems, postings, training, LSO review, work planning, PPE, procedures, Tier 1 inspections, warning systems   | 4        | 2 | 2 | 16 |             |  |  |               |  |
| Magnetic Field  | Adverse mechanical force exerted on ferromagnetic objects and or to electronic/medical implants. | Barriers, warning systems, postings, training, ASSRC review, work planning, procedures, Tier 1 inspections, magnetic safety reviews, medical exams   | 4        | 4 | 2 | 32 |             |  |  |               |  |
| Remotely Operated Equipment   | Becoming caught in or compressed by moving equipment   | Postings, barriers, guards, maintenance, training, work planning, procedures, Tier 1 inspections, ASSRC / ESRC reviews, design reviews LOTO  | 4        | 3 | 2 | 24 |             |  |  |               |  |
| Chemicals   | Personnel exposure   | Postings, barriers, PPE, maintenance, training, work planning, procedures, engineering controls, Tier 1 inspections, CMS, MSDS   | 3        | 2 | 2 | 12 |             |  |  |               |  |
| Chemicals - isoflurane  | Personnel exposure   | Training, ESH testing, engineering controls, administrative controls, work planning, EMTs, authorized entry only, safety reviews   | 3        | 2 | 2 | 12 |             |  |  |               |  |
| Chemicals – CO <sub>2</sub>   | Personnel exposure   | Postings, barriers, PPE, training, ESH testing, engineering controls, carbon dioxide detector and alarm, procedures, administrative controls, work planning, EMTs, authorized entry only, safety reviews       | 3        | 2 | 2 | 12 |             |  |  |               |  |
| Chemicals – Propane Gas   | Fire   | Engineering controls, training, fire department response, fire alarms  | 3        | 2 | 4 | 24 |             |  |  |               |  |
| Cell and tissue manipulation  | Being struck against an object, such as sharps   | Training, engineering controls, administrative controls, work planning, ESRC and IRB review, spill controls, BBP medical protocol, PPE   | 3        | 2 | 2 | 12 |             |  |  |               |  |
| Medical waste handling  | Being struck against an object, such as sharps   | Training, engineering controls, administrative controls, work planning, ESRC and IACUC review, PPE   | 3        | 2 | 2 | 12 |             |  |  |               |  |
| Animal  | Bites and scratches  | Training, engineering controls, administrative controls, work planning, ESRC and IAUCC review, PPE, trained animal handlers  | 3        | 1 | 3 | 18 |             |  |  |               |  |
|   |  |  |          |   |   |    |             |  |  |               |  |
|   |  |  |          |   |   |    |             |  |  |               |  |
| Further Description of Controls Added to Reduce Risk:<br>1. The medical waste at NSRL is mostly handled by Medical Department so this hazard is minimized for C-AD staff.<br>2. Currently C-AD is reviewing a system to be installed within a year that will use a robotic manipulator to place cell samples into and out of the beam line. This may have additional hazards, which will be reviewed and addressed during the design review and RSC/ASSRC/ESRC reviews. |  |  |          |   |   |    |             |  |  |               |  |
| *Risk:  | 0 to 20  | 21 to 40   | 41-60    |   |   |    | 61 to 80    |  |  | 81 or greater |  |
|   | Negligible   | Acceptable   | Moderate |   |   |    | Substantial |  |  | Intolerable   |  |